



MODEL 3171

BACK PRESSURE / RELIEF REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

Model 3171 is a back pressure/relief regulator used to control upstream (inlet or P_1) pressure. Inlet and Outlet size is 1/2" with Tri-Clamp® connections. The 3171 incorporates a stainless steel body. Refer to Technical Bulletin 3171-TB for specific design conditions and selection recommendations.

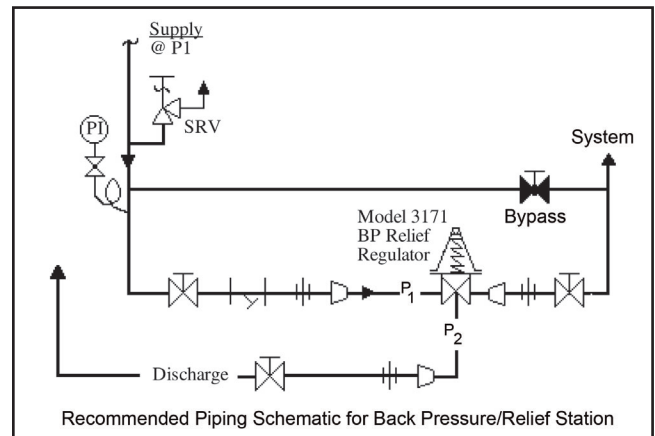
⚠ CAUTION

This is not a safety device and must not be substituted for a code approved pressure safety relief valve or rupture disc.

SECTION II

II. INSTALLATION

1. An inlet block valve should be installed upstream of the regulator.
2. If service application is continuous such that shutdown is not readily accomplished, it is recommended that an inlet block valve, outlet block valve, and a manual bypass valve be installed.
3. An inlet pressure gauge should be located approximately ten pipe diameters upstream, and within sight.



⚠ WARNING

The maximum inlet pressure is equal to 1.2 times the larger number of the stated range spring on the nameplate, and is the recommended "upper operative limit" for the sensing diaphragm. Higher pressures could damage the diaphragm. (Field hydrostatic tests frequently destroy diaphragms. DO NOT HYDROSTATIC TEST THROUGH AN INSTALLED UNIT; ISOLATE FROM TEST.)

4. All installations should include an upstream relief device if the inlet pressure could exceed the pressure rating of any equipment or the maximum inlet pressure rating of the unit.
5. Flow Direction: Install so the flow direction matches the arrow cast on the body. Connect the inlet pressure to the body side connection. Fluid will relieve out of the bottom connection.
6. Install unit with spring chamber (2) in the vertical position to allow for proper draining.

⚠ CAUTION

Installation of adequate overpressure protection is recommended to protect the regulator from overpressure and all downstream equipment from damage in the event of regulator failure.

SECTION III

III. PRINCIPLE OF OPERATION

1. Movement occurs as pressure variations register on the diaphragm. The registering pressure is the inlet, P_1 , or upstream pressure. The range spring opposes diaphragm movement. As inlet pressure drops, the range spring pushes the diaphragm

down, closing the port; as inlet pressure increases, the diaphragm pushes up and the port opens.

2. A complete diaphragm failure will cause the regulator to fail close and process fluid will discharge from the spring chamber vent hole.

SECTION IV

IV. START-UP

1. Start with the block valves closed. A bypass valve may be used to maintain inlet pressure in the upstream system without changing the following steps.
2. Relax the range spring by turning the adjusting screw counter clockwise (CCW) a minimum of three (3) full revolutions. This reduces the inlet (upstream) pressure setpoint.
3. If it is a "hot" piping system, and equipped with a bypass valve, slowly open the bypass valve to pre-heat the system piping and to allow slow expansion of the piping. Closely monitor inlet (upstream) pressure via gauge to ensure not over-pressurizing. **NOTE:** *If no bypass valve is installed, extra caution should be used in starting up a cold system; i.e. do everything slowly.*
4. Crack open the inlet (upstream) block valve.
5. Slowly open the outlet (downstream) block valve observing the inlet (upstream) pressure gauge. Determine if the regulator is flowing. If not, slowly rotate the regulator adjusting screw counter clockwise (CCW) until flow begins.
6. Continue to slowly open the outlet (downstream) block valve until fully open.

7. Observing the inlet (upstream) pressure gauge, rotate the adjusting screw clockwise (CW) slowly until the inlet pressure begins to rise. Rotate CW until the desired setpoint is reached.
8. Continue to slowly open the inlet (upstream) block valve. If the inlet (upstream) pressure exceeds the desired setpoint pressure, rotate the adjusting screw CCW until the pressure decreases.
9. When flow is established steady enough that both the outlet and inlet block valves are fully open, begin to slowly close the bypass valve, if installed.
10. Develop system flow to a level near its expected normal rate, and reset the regulator setpoint by turning the adjusting screw CW to increase inlet pressure, or CCW to reduce inlet pressure.
11. Reduce system flow to a minimum level and observe setpoint. Inlet pressure will rise from the setpoint of Step 9. (Ensure that this rise does not exceed the stated upper limit of the range spring by greater than 20% i.e. 20-80 psig (1.38 - 5.52 Barg) range spring, at maximum flow the inlet pressure should not exceed 1.2 x 80 psig (5.6 Barg), or 96 psig (6.6 Barg). If it does, consult factory).
12. Increase flow to maximum level, if possible. Inlet (upstream or P_1) pressure should fall off. Readjust setpoint as necessary at the normal flow rate.

SECTION V

V. SHUTDOWN

1. On systems with a bypass valve, and where system pressure is to be maintained as the regulator is shut down, slowly open the bypass valve while closing the inlet (upstream) block valve. Fully close the inlet (upstream) block valve. (When on bypass, the system pressure must be constantly observed and manually regulated. Close the outlet (downstream) block valve.



CAUTION

Do not walk away and leave a bypassed regulator unattended.

2. If the regulator and system are to both be shut down, slowly close the inlet (upstream) block valve. Close the outlet (downstream) valve only if regulator removal is required.

SECTION VI

VI. MAINTENANCE



WARNING

SYSTEM UNDER PRESSURE. Prior to performing any maintenance, isolate the regulator from the system and relieve all pressure. Failure to do so could result in personal injury.

A. General:

1. Maintenance procedures hereinafter are based upon removal of the regulator unit from the pipeline where installed.
2. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of nonreusable parts, i.e. gaskets, etc.
3. Refer to Figure 2 for the basic regulator, item number reference ().

B. Diaphragm Replacement:

1. Secure the body (1) in a vise with the spring chamber (2) oriented upwards. Ensure that the body (1) is not held in the vise by the end connection flanges.



WARNING

SPRING UNDER COMPRESSION. Prior to removing spring chamber, relieve spring compression by backing out the adjusting screw. Failure to do so may result in flying parts that could cause personal injury.

2. Relax range spring (16) by turning adjusting screw (5) CCW until removed from spring chamber (2).
3. Loosen spring chamber (2) by placing wrench on "flats" and rotating CCW making sure **not** to use the flats on either side of the vent hole.
4. Remove spring chamber (2), range spring (16) and spring button (4).
5. Remove the diaphragm subassembly consisting of the pressure plate nut (7), lock washer (6), pressure plate (3), diaphragm (10), piston O-ring (13) and piston (12).
NOTE: Refer to the quantity of diaphragms (10) incorporated per the bill of materials listing. Depending on inlet pressure level, multiple metal diaphragms may be "stacked".

6. Loosen pressure plate nut (7) and separate all parts (3, 6, 7, 10, 12 & 13) of the diaphragm subassembly.

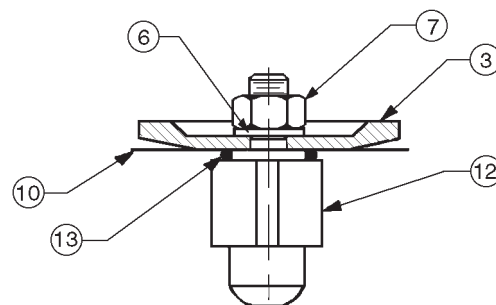


FIGURE 1: Diaphragm Subassembly

7. Inspect pressure plate (3) to ensure no deformation due to over-pressurization. If deformed, replace.
8. Remove diaphragm gasket (11). (If a composition diaphragm is used there is no diaphragm gasket.)
9. Clean body (1) and diaphragm flange in accordance with owner's cleaning procedures. Do not scratch diaphragm O-ring seating surface **NOTE:** Maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1576. Contact factory for details.
10. Reassemble diaphragm subassembly by placing piston O-ring (13), diaphragm(s) (10), pressure plate (3) and lock washer (6) over threaded post of piston (12). Ensure the pressure plate (3) is placed with curved outer rim down next to the diaphragm (10) surface. Tighten the pressure plate nut (7) to the following torques:

Sizes	Diaphragm	Torque
ALL	Metal	60 in #
	Composition	15 in #

11. For metal diaphragm(s) (10), place diaphragm gasket (11) into body recess (none required for composition diaphragm). Set diaphragm subassembly into the body.
12. Place the range spring (16) over the pressure plate nut (7) of the diaphragm subassembly.
13. Place multi-purpose, high temperature grease into depression of spring button (4) where adjusting screw bears. Set spring button (4) onto range spring (16); ensure spring button is laying flat on top of spring.

14. Rotate the spring chamber (2) CW by hand into the threaded portion of the body (1) ensuring not to cross thread. Continue rotating CW until rotation stops. Wrench tighten to 30-35 ft-lbs torque.
15. Reinstall adjusting screw (5) with locknut (8) into the spring chamber.
16. Pressurize with air and soap solution test around body (1) and spring chamber (2) for leakage. Ensure that an inlet pressure is maintained during this leak test of at least mid-range spring level; i.e. 20-80 psig (1.38-5.52 Barg) range spring, 50 psig (3.45 Barg) test pressure minimum.

C. Piston / Seat Replacement:



CAUTION

To prevent damage to body, use lead jaws when clamping body in a vise. Position body so that vise does not close over inlet and outlet connections.

1. Trim removal requires that diaphragm subassembly be removed and disassembled. Refer to previous procedure, Section VI.B.
2. Inspect inside surface of cylinder wall inside the body. (**NOTE:** *The cylinder is an integral part of the body. Replace the regulator should any damage be noted on the cylinder or seat surfaces*). If there are no signs of erosion/wear on seating surfaces, piston (12) alone may be replaced.

If composition seat (14) is damaged or worn, rotate the set screws (15) CCW to remove. Grasp the seat and pull it out of the piston(12). Insert new seat into the end of the piston and install set screws to hold the seat in place.

3. Clean body (1) cavity. Clean all parts to be reused. **NOTE:** *Maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1576. Contact factory for details.*
4. Reinstall diaphragm subassembly per Section VI.B., Diaphragm Replacement.
5. Bench test unit for suitable operation. **NOTE:** *Regulators are not tight shut off devices. Even if pressure falls below setpoint, a regulator may or may not develop bubble tight shut off. In general, tighter shut off can be expected with composition seat.*
6. Spray liquid leak detector to test for leakage around body (1) and spring chamber (2) joint for leakage. Test pressure should be the maximum allowed by the range spring (16) at the inlet.

SECTION VII

VII. TROUBLE SHOOTING GUIDE

1. Erratic operation; chattering.

Possible Cause	Remedy
A. Oversized regulator.	A1. Check actual flow conditions, re-size regulator for minimum and maximum flow. A2. Increase flow rate. A3. Decrease regulator pressure drop; decrease inlet pressure by placing a throttling orifice in inlet piping union. A4. Install next step higher range spring. Contact factory. A5. Before replacing regulator, contact factory.
B. Worn piston; inadequate guiding.	B. Replace regulator.

2. Regulator inlet (upstream) too high:

Possible Cause	Remedy
A. Regulator undersized.	A1. Confirm by opening bypass valve together with regulator. A2. Check actual flow conditions, re-size regulator; if regulator has inadequate capacity, replace with larger unit.
B. Incorrect range spring (screwing out CCW of adjusting screw does not allow bringing pressure level to proper level).	B. Replace range spring with proper lower range. Contact factory.
C. Too much rise (build).	C1. Review rise (build) expected. C2. Contact factory.

3. Leakage through the spring chamber vent hole.

Possible Cause	Remedy
A. Normal-life diaphragm failure.	A. Replace diaphragm.
B. Abnormal short-life diaphragm failure.	B1. Can be caused by excessive chattering. See No. 1. to remedy chatter. B2. Can be caused by corrosive action. Consider alternate diaphragm material. B3. For composition diaphragms, ensure not subjecting to over-temperature conditions. B4. Upstream (inlet) pressure build-up occurring that overstresses diaphragms. Relocate regulator or protect with safety relief valve.
C. O-ring failure.	C. Replace O-ring (13), apply appropriate torque.

4. Sluggish operation.

Possible Cause	Remedy
A. Plugged spring chamber vent.	A. Clean vent opening.
B. Fluid too viscous.	B. Heat fluid. Contact factory.

SECTION VIII

VIII. ORDERING INFORMATION NEW REPLACEMENT UNIT vs PARTS "KIT" FOR FIELD REPAIR

To obtain a quotation or place an order, please retrieve the Serial Number and Product Code that was stamped on the metal name plate and attached to the unit. This information can also be found on the Bill of Material ("BOM"), a parts list that was provided when unit was originally shipped. (Serial Number typically 6 digits). Product Code typical format as follows: (last digit is alpha character that reflects revision level for the product).

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NEW REPLACEMENT UNIT:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. With this information they can provide a quotation for a new unit including a complete description, price and availability.



CAUTION

Do not attempt to alter the original construction of any unit without assistance and approval from the factory. All purposed changes will require a new name plate with appropriate ratings and new product code to accommodate the recommended part(s) changes.

PARTS "KIT" for FIELD REPAIR:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. Identify the parts and the quantity required to repair the unit from the "BOM" sheet that was provided when unit was originally shipped.

NOTE: *Those part numbers that have a quantity indicated under "Spare Parts" in column "A" reflect minimum parts required for inspection and rebuild, - "Soft Goods Kit". Those in column "B" include minimum trim replacement parts needed plus those "Soft Goods" parts from column "A".*

If the "BOM" is not available, refer to the cross-sectional drawings included in this manual for part identification and selection.

A Local Sales Representative will provide quotation for appropriate Kit Number, Price and Availability.

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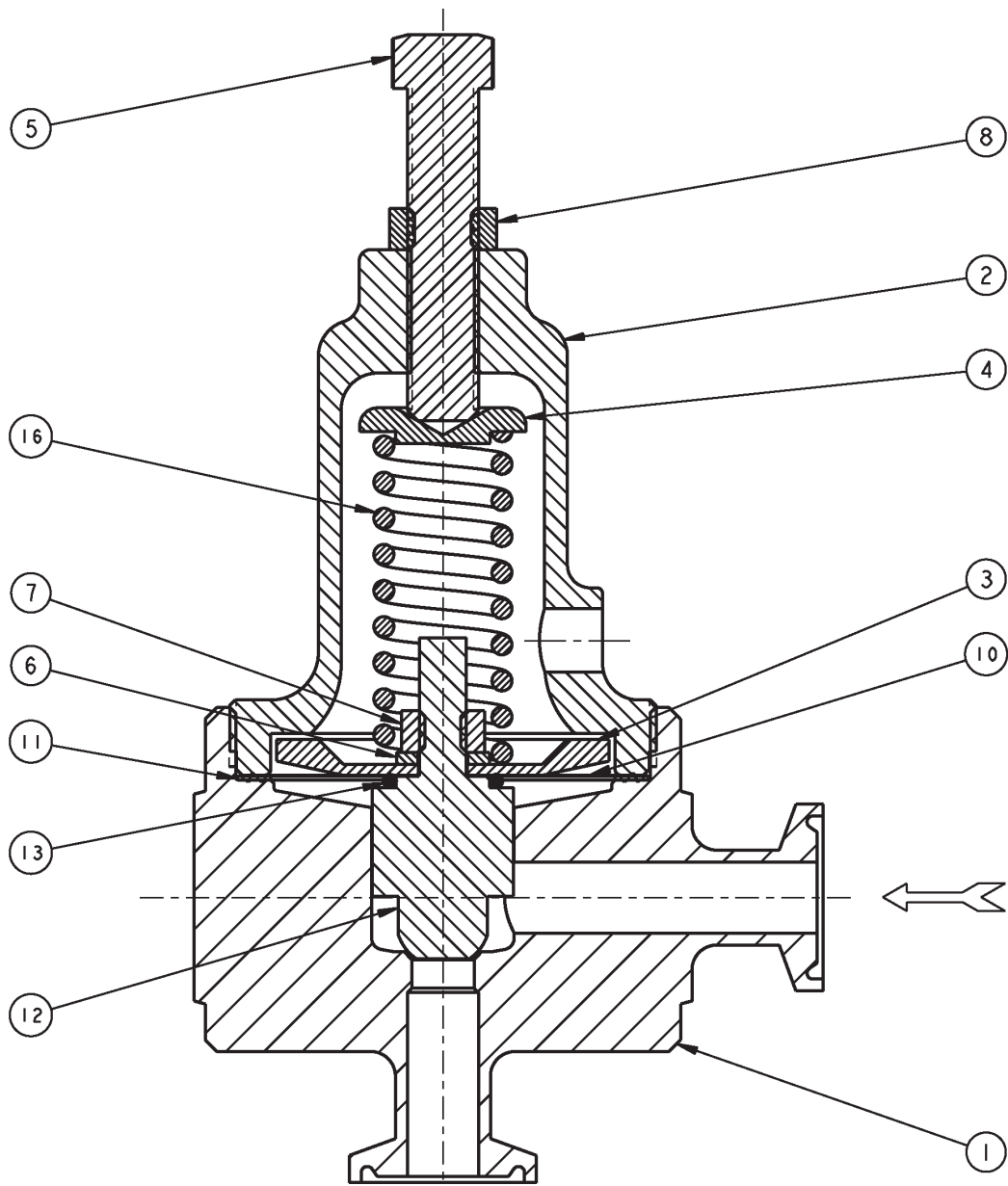


FIGURE 2
Model 3171 Metal Seat

Item No.	Description	Repair Kit B
1	Body	
2	Spring Chamber	
3	Pressure Plate	
4	Spring Button	
5	Adjusting Screw	
6	Lock Washer	
7	Pressure Plate Nut	
8	Adjusting Screw Lock Nut	
9	Nameplate	
10	Diaphragm -----	##
11	Diaphragm Gasket -----	##
12	Piston -----	##
13	Piston O-ring -----	##
14	Composition Seat -----	##
15	Seat Set Screws -----	##
16	Range Spring	

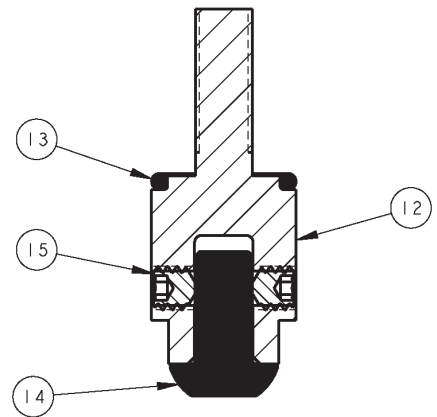


FIGURE 3
Composition Seat



IOM ADDENDUM:

ATEX DIRECTIVE 2014/34/EU and THE EQUIPMENT AND PROTECTIVE SYSTEMS INTENDED FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES REGULATIONS 2016

Cashco, Inc. declares that the products listed in the table below has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II of the ATEX Directive 2014/34/EU and given in Schedule 1 of The Equipment and Protective Systems Indented for Use in Potentially Explosive Atmospheres Regulations 2016. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN ISO 80079-36:2016 and EN ISO 80079-37:2016. The product will be marked as follows:



The 'X' placed after the technical file number indicates that the product is subject to specific conditions of use as follows:

1. The maximum surface temperature depends entirely on the operating conditions and not the equipment itself. The combination of the maximum ambient and the maximum process medium temperature shall be used to determine the maximum surface temperature and corresponding temperature classification, considering the safety margins described prescribed in EN ISO 80079-36:2016, Clause 8.2. Additionally, the system designer and users must take precautions to prevent rapid system pressurization which may raise the surface temperature of system components and tubing due to adiabatic compression of the system gas. Furthermore, the Joule-Thomson effect may cause process gases to rise in temperature as they expand going through a regulator. This could raise the external surface temperature of the regulator body and the downstream piping creating a potential source of ignition. Whether the Joule-Thomson effect leads to heating or cooling of the process gas depends on the process gas and the inlet and outlet pressures. The system designer is responsible for determining whether the process gas temperature may raise under any operating conditions.
2. Where the process medium is a liquid or semi-solid material with a surface resistance in excess of $1G\Omega$, special precautions shall be taken to ensure the process does not generate electrostatic discharge.
3. Special consideration shall be made regarding the filtration of the process medium if there is a potential for the process medium to contain solid particles. Where particles are present, the process flow shall be $<1\text{m/s}$ ($<3.3\text{ ft/s}$) in order to prevent friction between the process medium and internal surfaces.
4. Effective earthing (grounding) of the product shall be ensured during installation.
5. The valve body/housing shall be regularly cleaned to prevent build up of dust deposits.
6. Regulators must be ordered with the non-relieving option (instead of the self-relieving option) if the process gas they are to be used with is hazardous (flammable, toxic, etc.). The self-relieving option vents process gas through the regulator cap directly into the atmosphere while the non-relieving option does not. Using regulators with the self-relieving option in a flammable gas system could create an explosive atmosphere in the vicinity of the regulator.
7. Tied diaphragm regulators with outlet ranges greater than 7 barg (100 psig) should be preset to minimize the risk that improper operation might lead to an outboard leak and a potentially explosive atmosphere.
8. All equipment must only be fitted with manufacturer's original spare parts.
9. Ensure that only non-sparking tools are used, as per EN 1127-1, Annex A.

	PRODUCT
REGULATORS	31-B, 31-N
	1164, 1164(OPT-45)
	1171, 1171(OPT-45), 1171(CRYO)
	2171, 2171(OPT-45), 2171(CRYO), 3171
	1465, 3381, 3381(OPT-45), 3381(OPT-40)
	4381, 4381(OPT-37), 4381(CRYO), 4381(OPT-45), 5381
	MPRV-H, MPRV-L
	PBE, PBE-L, PBE-H
	CA-1, CA-2
	CA1, SA1, CA4, SA4, CA5, SA5
	DA2, DA4, DA5, DA6, DA8
	DA0, DA1, DAP, SAP
	SLR-1, SLR-2, PTR-1
	ALR-1, ULR-1, PGR-1
	BQ, BQ(OPT-45), BQ(CRYO)
	123, 123(CRYO), 123(OPT-45), 123(OPT-46G)
	123-1+6, 123-1+6(OPT-45), 123-1+6(OPT-46G), 123-1+6+S, 123-1+6+S(OPT-40)
	1000HP, 1000HP(OPT-37), 1000HP(OPT-45), 1000HP(OPT-45G), 1000HP(CRYO)
	1000HP-1+6, 1000HP-1+8, 1000LP, 1000LP(OPT-45), 1000LP(OPT-46G)
	6987
	8310HP, 8310HP-1+6, 8310HP-1+8, 8310LP, 8311HP, 8311LP
	345, 345(OPT-45)
	BA1/BL1, PA1/PL1
	C-BPV, C-PRV, C-CS
	D, D(CRYO), D(OPT-37), D(OPT-20), D(OPT-45)
	DL, DL(LCC), DL(OPT-45)
	BR, BR(CRYO)
	HP, HP(LCC), HP(OPT-45), HP(OPT46G), HP-1+6+S(OPT-40), HP-1+6+S
	P1, P2, P3, P4, P5, P7
	B2, B7
	POSR-1, POSR-2
	5200P, 5300P
135	
NW-PL, NW-SO	
CG-PILOT	
FG1	
CONTROL VALVES	RANGER, 987, PREMIER
	964, 521, 988, 988-MB, 989
	2296/2296HF
	SCV-30, SCV-S
TANK BLANKETING	8700, 8910, 8920, 8930, 8940
	2100, 2199
	3100, 3200, 3300, 3400, 3500, 3600, 3700
	1078, 1088, 1100, 1049
	5100, 5200, 5400, 5500
	4100, 4200, 4300, 4400, 4500, 4600
MISC	764P/PD, 764-37, 764T

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